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TURNING DOMESTIC WASTES TO RESOURCES IN FCT, ABUJA NIGERIA.

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ABSTRACT

This study was carried out to look at turning domestic wastes to resources in Area councils of FCT, Abuja. Questionnaire, In-depth Interview (IDI), field observation and survey of households were used in the research. The Questionnaire were shared to 400 respondents used as sample size for the study. In the survey of households, four towns/villages were selected. Density and level of income were considered in selection of the households. Ten (10) households were randomly selected from each of the twenty-four (24) selected towns. Wastes were collected from these households and sorted into their various categories and their weights taken. Interviews were conducted in public places like motor parks, super markets etc. Some waste scavengers, itinerant waste dealers/ collectors were also interviewed. The data generated were analysed using Chi-Square.The results showed that cans and scrap metals, assorted plastics, and bottles and glass materials are the major materials that attract the attention of waste entrepreneur in FCT. These are collected, gathered and transported to Kaduna, Kano and Lagos. Only 20% is locally recycled in FCT. This may be due to lack of modern recycling plants in the study area. The bulk of non-degradable wastes are potentially recyclable materials, while the degradable which formed the bulk of the waste can be composted. The study recommended that waste reduction, reuse, recycle/compost, waste combustion and landfill should be strictly adopted and followed.

KEY WORDS: Domestic, Wastes, Resources, Compost, Recycle.

INTRODUCTION

According to the United State Environmental Protection Agency, 2014, Waste can be defined as any rejected or unwanted materials. Waste in general terms according to USAID, 2010, is an unwanted and inherent product of social, economic and cultural life. These suggests that waste must occur in such a volume or

concentration as to cause a significant changes in the environment. Thus, apart from waste being an unwanted substance that is discarded, the amount of it and the impact it makes on the environment is also important in defining wastes. According to Benjamin *et al.,* 2014, Wastes could be classified into different types depending on their sources.

1. Domestic/Household or municipal wastes: This is non-putrescible wastes consisting of combustible materials, such as paper, cardboard, yard clipping, wood or similar materials, generated in a dwelling or residential areas.

2.Industrial wastes or hazardous wastes: These are waste materials that arise from industries; these could be solid, liquid, sludge or gas.and

3.Biomedical or hospital wastes. And according to Open Wash (2016), waste could also be classified into; Biodegradable and non-biodegradable wastes. Biodegradable solid wastes are those that can be decomposed by the natural processes and converted into the elemental form by bacteria and other microorganisms. Food wastes, manures and waste from producing crops are the main biodegradable wastes. Non-biodegradable (sometimes called inorganic) solid wastes are those that do not decomposed by microbial action. These wastes include plastic containers, scrap metals, food and drink cans, and plastic bags.

Human beings produce waste of various types; for example, urine and faeces, wastes from washing and cooking, and solid waste produced at home and in work places, schools, hospitals and other public buildings. All these wastes need to be controlled and managed for the benefit of people and the environment that they live in. In urban areas, managing these wastes is a difficult problem. Waste management according to the (European commission, 2019) is the collection, transportation, recovery and disposal of waste, including the supervision of such

operations and the after - care of disposal site, and actions taken as a dealer or broker. Many countries of the world including Nigeria were recognizing the importance of environmental planning and management, and have joined many international organizations. Nigeria is now an active member of INFORTERRA, the global environmental information network with focal points in 68 countries. Information concerning change in the local and international environment are disseminated through this forum. As observed by (Oluwole, 2014) in countries around the world, one major environmental problem that confronts municipal authorities is solid waste management. The study posited that cities, governments and dwellers are confronted by problem of solid waste generation. It also maintained that, in third world cities, between one-third and one-half of the solid wastes generated remain uncontrolled. In high -income countries, the issue associated with solid waste usually centered on the difficulties and high cost of disposing the large quantity of solid wastes generated from different sources. And of most striking concern are the management problems of domestic wastes. The management of domestic waste is one of the huge challenges of the urban areas of all sizes. From big cities to small, it is always in the top the most challenging problems for city managers. The disposal of domestic solid waste generated is particularly problematic in cities of developing countries. In this regard Nigeria is not exempted as evidences show that the problems associated with poor domestic waste disposal are daily realities in most Nigeria cities.

In Nigeria, there is no doubt that a new environmental consciousness is evolving. The public is beginning to talk about the environment even as numerous single issues, environmental groups are emerging. At some point, major public events including natural disasters, flood and erosion as well as threats of cholera, and typhoid have increased people's interest. Membership in existing environmental

groups is increasing even as new programmes and opportunities are appearing. These, however, are hardly enough to combat the problem that if not given urgent attention will negatively affect the security of our beloved and great nation (Evelyn, 2012). Still in our memory is the 1996 saga of typhoid, cholera, meningitis etc. which even affected the country's diplomatic relationship with other nations. All these were as a result of poor sanitary conditions. Omole and Alankinde (2013), showed that waste management present problems in a mega city like Lagos, Kano and other major Nigeria cities which are linked with economic development, population growth and the inability of municipal councils to manage the resulting rise in industrial and domestic wastes. Haphazard industrial planning, increased urbanization, poverty and lack of competence of the municipal government are seen as the major reasons for high levels of waste pollutions in major Nigerian cities. Some of the solutions have been disastrous to the environment, resulting in untreated waste being dumped in places where it can pollute waterways and ground water (Stridha and Hammed, 2014). It is very important to understand the nature of wastes, problems associated with them, and how to hygienically dispose them off. In Nigeria today, there are no underground drainage system and as a result all liquid waste find their way into water courses. There are no urinals or toilet facilities in many public areas. Schools are devoid of functional toilets as a result of that wastes are found everywhere and anywhere. In Nigeria, waste is generated at the rate of 0.43kg/head per day and 60 to 80 % of it is organic in nature (Sridha and Hammed, 2014). A cow brought for slaughtering produces about 328.4 kg of wastes in the form of dung, bone, blood, horn and hoof. Sheep and rams produce about 0.9kg waste per head per day (based on observation). The markets generate a variety of wastes for example, corn cob, vegetable wastes, packaging materials etc. The household wastes also contain other materials such as paper, glass, metal, plastic and other non-biodegradable materials and some of

them are excellent raw materials for various industries in the country. People litter the roads with no civic concern. All these wastes contain a lot of valuable resources in the form of nitrogen, phosphorus, potassium and other chemicals which are useful (Hammed, 2013). Microorganisms play an important role in biodegradable cycles and convert these valuable resources into harmless and useful products for example organic fertilizer can improve the physical condition of the soil and increase the level of micro nutrients which encourage the organically produced food, to positioned Nigeria as a potentially competitive organic food supplier on the world market.

In Abuja Municipal Area waste composition is heterogeneous and mixed: biodegradable and non-biodegradable components. The waste is not segregated at the source and comprises of hazardous and non-hazardous waste. The hazardous components usually consist of household cleaning agents and left-over chemicals (Yahaya, 2014) (Kadafa *et al.*,2013)

LITERATURE REVIEW

According to Adewale (2011), municipal solid waste is defined as non-air and sewage emissions created within and disposed off by a municipality, including household garbage, commercial refuse, construction and demolition debris, dead animals and abandoned vehicles. Butu and Mshelia (2014) was of the view that Municipal Solid Waste (MSW) are regarded as discarded materials arising from operational activities taken place in different land use such as residential, commercial and industrial. Domestic or residential wastes are those that are collected from dwelling places on a regular basis, such waste include organic matter resulting from preparation and consumption of food, rags, nylon and ashes are the remains after various cooking and heating processes. The commercial wastes are those that arise from shops, Supermarkets, market and others; they include paper carton, polythene bags and nylons. The industrial wastes are those waste materials that arise

from industries; these could be solid, liquid, sludge or gas. According to Omole and Alankinde (2013) industrial waste include metals, scraps, chips and grits from machine, shops, sawdust, paper pieces and glass. USEPA (2017) classified solid waste into three categories, namely; garbage, ashes and rubbish. The garbage includes organic matter resulting from preparation and consumption of food. Ashes include remains from cooking and heating process and the rubbish may either take the form of combustible such as paper, wood, leaves and weeds or non-combustible such as glass, plastic, polythene and metal materials. Stridha and Hammed (2014) classified solid waste into two categories by its characteristics. These are organic solid waste and inorganic solid waste. Organic solid wastes are those that are generally biodegradable and decompose in the process of which emits offensive and irritating smell when left unattended. These are putrescible waste e.g. garbage. Inorganic solid wastes are those that do not decompose at any rate. This category of waste matter may be combustible depending on the type of the nature of the material they constitute. According to Tutor Vista (2017), wastes are classified either by where it is generated or by its composition (whether biodegradable or not).

Biodegradable solid wastes are those that can be broken down (decomposed) into their constituent elements by bacteria and other microorganisms. Food wastes, manures and waste from producing crops are the main biodegradable wastes. Non-biodegradable (sometime called inorganic) solid wastes are those that do not decompose by microbial action. These wastes include plastic containers, scrap metal, food and drink cans and plastic bags. Materials in solid wastes can also be classified as combustible or non-combustible, depending on whether they will burn or not. The majority of substances composing municipal solid waste include paper, vegetable matter, plastics, metals, textiles, rubber and glass (USEPA, 2014).

Recycling and Re-use

Recycling involves using waste as material to manufacture a new product. It involves altering the physical form of an object or material and making a new object from the altered material. Recycling/recovery and re-use of wastes conserves energy and the practice is valued as it is environmentally friendly. After waste prevention, recycling has been shown to result in the highest climate benefit compared to other waste management approaches. Industrial symbiosis which involves the exchange of resources including by-products among industrial enterprises, which may form recycling clusters to facilitate sharing resources. UNEP 2010, is of the belief that, industrial symbiosis in both developed and developing regions have shown that measurable environmental and economic benefit with respect to air, water, and waste. They argued that greenhouse gas savings may be associated with reduced use of raw materials, reduce transportation (of wastes to landfill), and fossil fuel substitution in greenhouse gas (GHP) facilities (where there is an industrial use for heat). The recycling has environmental benefits at every stage in the life cycle of a consumer products from the raw material with which it's made to it final method of disposal. Apart from reducing greenhouse gas (GHG) emissions, which contribute to global warming, recycling also reduces air and water pollution associated with making new products from raw materials. By utilising used, unwanted, or obsolete materials as industrial feed stocks or for new materials or products. Recycling also provides significant economic and job creation impacts. For example, America recovered almost 65 million tons of municipal solid waste through recycling, composting recovered over 20 million tons of wastes, combusted about 29 million tons for energy recovery (about 12%) and discarded only 2.9 pounds per person per day (USEPA, 2010). Recyclable materials are recovered from municipal refuse by a number of methods, including hand picking and sorting, shredding, magnetic separation of materials, air classification that separates light and heavy fractions, screening and washing. Re-use require less mechanical energy for sorting, processing and transporting. It also requires waste to be separated before its potential

degradation, direct reuse of a product without changing it basic form is common example of reuse. For example, packaging containers such as cans, bottles or boxes can be directly reused. Yahaya (2014) is of view that Standardization of bottles by pharmaceutical companies in Abuja has facilitated this level of reuse. Reuse material is of importance to our society due to our various activities and also to reduce pressure on the environment. And when not properly managed it clog the drainage. USEPA (2014) show that the followings are ways and practice of converting wastes into useful assets.

- Human or animal urine contain the element nitrogen, which is used as fertilizers.
- Animal bones can be made to be a very important animal feed after processing.
- Rural communities use dung for plastering of houses and as energy sources for open fire burning.
- Some people in bigger towns collect bottles, old shoes, cloths, metal product which is one form of recycling or re-use.

It stated that waste recovery and re-use is economically and socially feasible and acceptable.

Composting

Waste decomposes in an enclosed chamber due to activities of bacteria, using the oxygen that combined chemically with waste. Composting is a process of biological decomposition of under aerobic and haemophilic condition which breakdown organic materials leaving human rich residue. Composting is one of the means of waste minimization. The mechanism implies a biological waste treatment process. The action of microorganism breaks down complex organic compounds into simple ones (Ecohem, 2017). Composting systems treat biodegradable material such as food, animal industry wastes, green wastes, solid, and agricultural residues and

produce a range of organic soil amendment products that can replace manufactured fertilizers or peat, reduce the need for pesticides, improve soil structure, reduce erosion, and reduce the need for irrigation.

Well managed composting promotes clean and readily finished products, minimises nuisance potential and is simple to operate (Samrin, 2016). There is reduction in landfill space, reduce surface and ground water contamination.

Adewale (2011) argued that through composting waste blocking the rivers, canals, drainages could be reduced, it enhances recycling of materials and low transportation costs. In composting, there is a minimal emission of green-house gases with subsequent effect on climate change and global worming (Seo *et al*., 2014). Addition of compost to soil reduces soil erosion as well as improvement of soil`s structure, aeration and water retention. The use of chemical fertilizer could lead to ground water pollution but compost discourages water pollution. Simple composting systems are an effective low-technological solution for developing countries to reduce waste quantities and generate a valuable compost product for application to agriculture. Composting has been used widely for remediation of organic contaminants (Adewale, 2011).

Thermal Waste Treatment

This refers to mass-burn incineration, co-incineration (replacing fossil fuels with refuse-derived fuel (RDF) in conventional industrial processes, such as in cement factories, pyrolysis and gasification. Energy is recovered from the thermal treatment of waste, either as heat or electricity, which can equate to a considerable green-house gas (GHG) saving (depending on type of energy displaced). Metals are also recovered from incinerator as ash, and this contribute to further GHG benefits. Adewale (2011), is of the view that incineration of mixed wastes is unfeasible in developing countries because of cost and often unsuitable waste composition. Most of the wastes in these regions are characterized by a high percentage of putrescible

waste with high moisture and low calorific value making it unsuitable for incineration without considerable pre-treatment, such as pressing or drying.

Pyrolysis and Gasification

These are methods of managing wastes by heating under controlled conditions to produce low to medium heating fuel, gases, tars, char and ashes; under a high temperature with limited oxygen (Adewale,2011). Pyrolysis converts the solid wastes into solid, liquid and gas products while gasification converts organic materials into syngas (CO and H_2O). Pyrolysis is used to convert wood to charcoal that is used for domestic cooking. Though the effect of pyrolysis to environment is loss of biodiversity, desertification and emission of acid green-house gases (Adewale,2011).

Landfill

A method of disposing a refuse on land without creating nuisances or hazards to public health or safety. It is an economical method of wastes disposal in developing countries involving pitching refuses into a depression, abandoned mining void, excavated land (Adewale,2011). Municipal solid waste landfills are sources of methane emissions, which affect global climate change. According to USEPA (2017) given that all landfills generate methane, it makes sense to use the gas for beneficial purpose of energy generation rather than emitting it to the atmosphere. The gas is used in the generation of electricity power.

Integrated Solid Waste Management

One of the approaches to proper and adequate management of solid waste to minimise its negative impacts is the Integrated Solid Waste Management (ISWM). The ISWM is a strategic initiative involving sustained and comprehensive waste prevention, recycling, composting, combustion and disposal programme. An effective ISWM should most effectively protect human health and environment

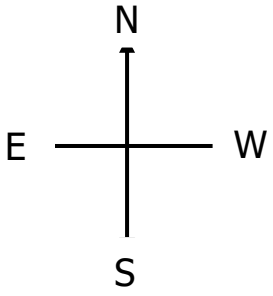
(USEPA, 2013 and UNEP, 2013). The waste prevention or source reduction activity seeks to prevent waste generation through the strategies involving the use of less packaging, designing longer lasting products, and reuse of products and materials. These steps ultimately lead to reduced disposal of cost and the generation of methane. Recycling on the other hand involves collecting, reprocessing and recovering certain waste materials to make new materials or products. While composting entails the conversion of waste materials into soil additives USEPA, 2013. These two last steps generate many environmental and economic benefits. Disposal on its part is done through landfill and combustion to manage wastes that cannot be prevented or recycled.

METHODOLOGY

The study area: This study was carried out in the Federal Capital Territory (FCT) Abuja of Nigeria. The Federal Capital Territory has a population size of 1,406239(NPC,2006). Abuja is geographically located at the centre of the country. It has a land mass of approximately 8000km^2, of which the actual city occupies 250km^2 (Freedom, 2012). FCT Abuja consist of six (6) Area Councils; Abuja Municipal Council (AMAC), Abaji, Bwari, Gwagwalada, Kuje and Kwali as shown in Fig. 1.

Fig 1: Map of Federal Capital Territory, Abuja.

Source: NPC, (2008).



Data Collection

This research was carried out through the use of Questionnaire, In-depth interview (IDI), field observation and survey of households. These gave an idea on sources and nature of the wastes/frequency and disposal methods. The Questionnaire were

shared to 400 respondents used as sample size for the study. In the survey of households, four towns/villages were selected from each of the six Area council and the towns selected were divided into high and low density areas. Other criteria that were used in this classification include level of income and nature of employment of the occupants, type and structure of buildings and classes of civil servants in accordance with the study carried out by Benjamin *et al.,(*2014). Ten (10) households were randomly selected from each of the twenty-four (24) selected towns. Wastes were collected from these households and sorted into their various categories and their weights taken. Interviews were conducted in public places like motor parks, super markets restaurants etc. Some waste scavengers, itinerant waste dealers, collectors were also interviewed. The data generated were analysed by the use of Chi-Square ($p< 0.05$).

RESULTS AND DICUSSION

Composition of Domestic Solid Waste in FCT

The composition of domestic solid waste generated in the FCT was determined and result presented in Tab 1. From the result, remnants of food materials constitute 46%, vegetable and other perishables constitute 32%, paper and cardboard constitute 4% and textile materials account for 3%. These are degradable wastes amounting to 85% of the total wastes. Others are polythene materials, which is because of its weightlessness accounts for only 5%, glass material constitutes3.61%, plastic and ceramics is 2.97% and the used cans account for 2.72%. The bulk of waste are degradable materials that can be composted while non-degradable wastes are potentially recyclable materials. The findings in previous studies by Adewale (2011) showed that the developing nations such as Indonesia, Colombo and Sri Lanka, residential wastes are 78%, 81% and 89% respectively. Kadafa (2017), also confirmed that over 70% 0f domestic solid waste in Nigeria cities are degradable. These degradable wastes may decay rapidly leading to high multiplication and subsequent contamination with bacteria and other microbes from the rotten food and

vegetables if not effectively managed. Some of these wastes are often removed by the less privileged for either direct consumption or sold to make money or for recycling back to the immediate communities, which may lead to the spreading of microbial infections that may be of serious public health concern. The infections may include among others cholera, typhoid fever, and shigellosis (UNDP 2014).

The biodegradable is large enough to be composted rather than disposed off. Composting can be used to handle biodegradable wastes such as food, animal industrial wastes, green waste, wood, paper and cardboard wastes, and agricultural residues to produce a range of organic soil amendment products that can replace manufactured fertilizer, reduce the need for pesticides, improve soil structure, reduce soil erosion and reduces the need for irrigation.These biodegradables can also be managed through heating under controlled conditions to produce low heating fuel, gases, tars, char and ashes pyrolysis converts solid wastes into solid, liquid or gas products while syngas can be produced through gasification. For example, Pyrolysis can be used to produce charcoal used for domestic cooking.

Tab 1: Composition of Domestic Solid Waste

Domestic solid wastes	Percentage(%)
Food and food crops	46
Vegetable and perishables	32
Glass materials	4
Paper and cardboards	4
Plastic and ceramics	3
Polythene materials	5
Used cans	3
Textile materials	3
Total	100%

The result from the study Area showed that recycling is carried out by informal sector and that, cans and scrap metals, assorted plastics, and bottles and glass materials are the major materials that attract the attention of waste entrepreneur in FCT as showed in Tab 2. The result shows that 28.3% of the recyclable waste collected are cans and scrap metals, 25.1% are assorted plastics, while 20.1% are bottle and glass materials, paper and cardboards is 18.5% and the least is polythene, 7.9%. And the study revealed that 28.5% of the recyclable wastes collected by scavengers come from motor parks, closely followed by the waste from the institutions (26%). Restaurants and dumpsites produce 19.5% and 21% respectively. While households produced the least of 8% as shown in Fig.2. The result of weekly recyclable waste collection shows that Abaji of FCT produces 19.6%, Gwagwalada and Kuje generate 18.5 and 18.3% respectively. Kwali generate 15.3% while Bwari produces 14.7% and AMAC produces 13.3% as shown in Fig.3. These materials are usually gathered at the strategic place for onward shipment by the dealers. This corroborates with previous studies carried out in Abuja by Imam and Wilson (2008), Kadafa *et al.* (2017) and also in conformity with studies of other Nigeria cities(Michael *et al.*,2014). The recyclable materials from sources are often collected by scavengers and reusable collectors patrolling house to house. Residents often sell their recyclables to itinerant buyers who call door to door or sometime deliver recyclables to service sites themselves. The buyers in turn sell the materials to nearby recyclable distribution centres where they are sorted and transported to other places, usually Kaduna, Kano or Lagos (Fig.4). Only 20.1% is locally consumed by artisanal recyclers in the FCT. This may be due to lack of modern recycling plants within the FCT. The local artisanal recyclers spatially distributed within the study area make use of some cans and metals for manufacture of locally use materials. Fig. 5 shows that 28.3% of the plastics/bottles are washed and reused by traditional herb sellers, and pharmaceutical factories take (26.9%). Locally made drinks like kunu and zobo (24.1%). While 20.1% of the plastics are used by honey producers.

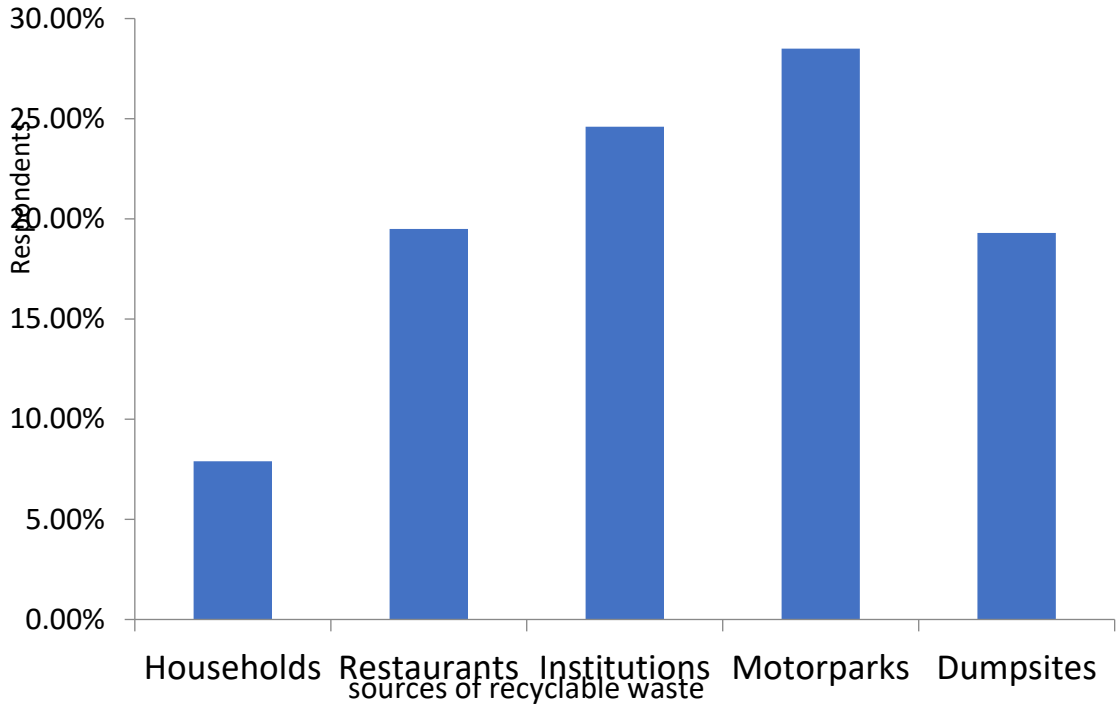


Figure 2: Sources of recyclable waste materials.

TAB 2: Types of Recyclable Waste Materials

Recyclables	Abaji	AMAC	Bwari	G/Lada	Kuje	Kwali	Total(kg)	%
Bottle & Glass mat.	12	14	10	15	13	12	76	20.1
Cans & metals	15	20	17	22	17	16	107	28.3
Plastics	15	16	16	20	14	14	95	25.1

Paper & c/board	13	10	12	13	11	11	70	18.5
Polythenes	15	7	4	6	4	4	30	7.9

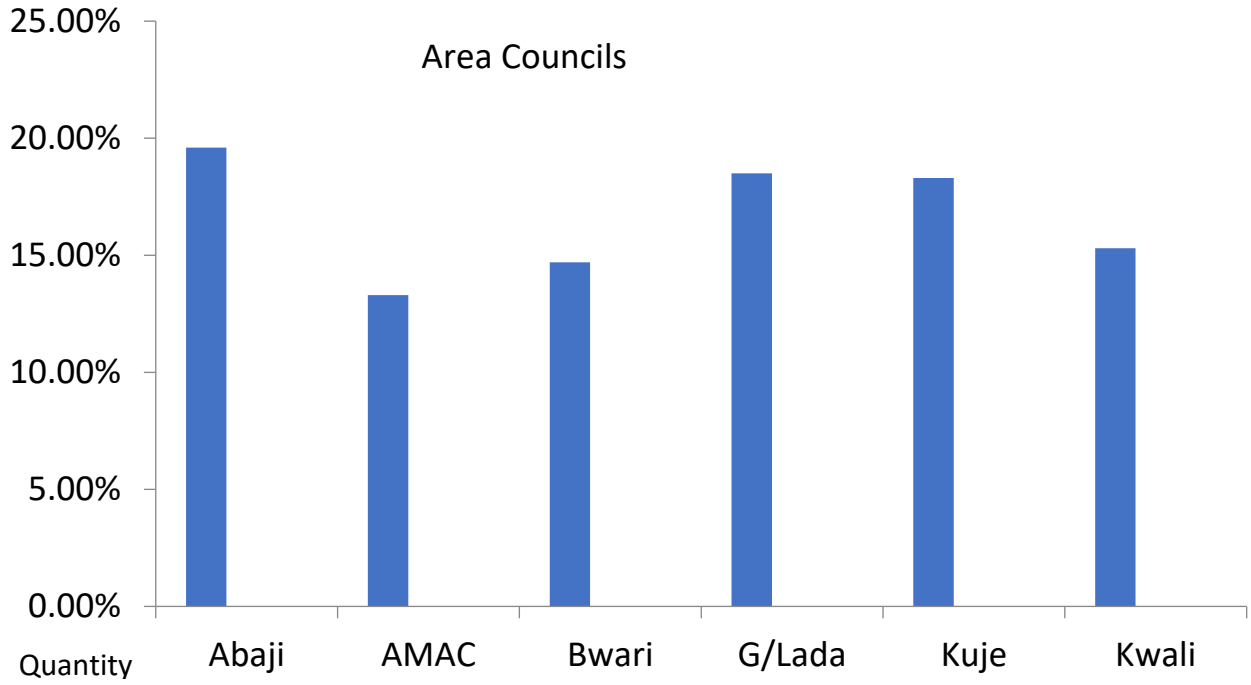


Figure 3: Quantity of waste materials collected weekly

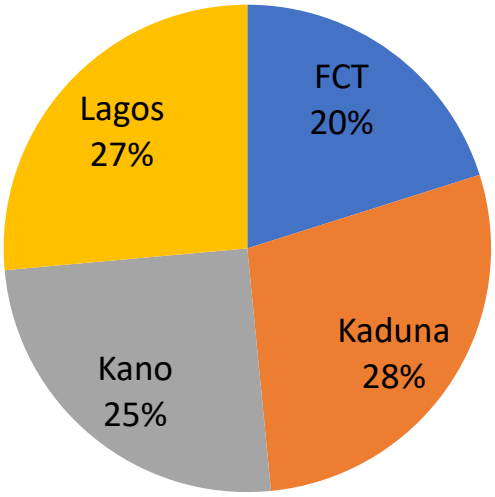


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Figure 4: Destination of the retrieved recyclable waste materials.

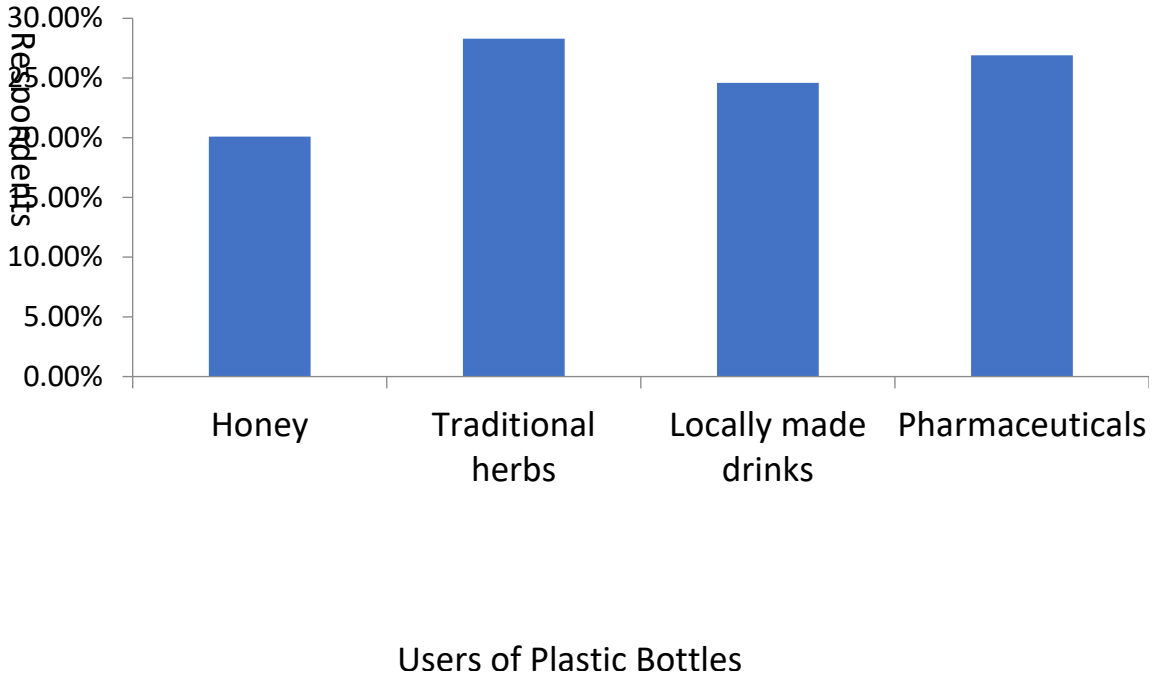

Figure 5: Major Users of Assorted Plastic Bottles in the Study Area

Similarly, the 4% reported for bottle and glass materials may be due to the common practice of salvaging some whole bottles especially those for soft drinks and wines leaving only a few of no return bottles of pharmaceutical origins as commonly practiced in Nigeria. The non-degradable materials are daily hunted for by human scavengers which might have led to the removal of these categories of wastes for recycling in exchange for cash in many areas of FCT. This assertion is confirmed by non-significant difference in the rate of generation of these wastes in the study area. Polythene and cellophane materials were found in all of the area councils. This is due to their common use in this area. Polythene bags and other polythene materials are used in the package of almost all the commercial and domestic products such as magi, biscuits, sweets, onions, vegetable, grains etc. This explains the level of polythene usage as the common commercial material that littered our environment today but because of its weightlessness account for 5%. However, since they are non-degradable, if carelessly dumped in the environment may lead to accumulation, block the water ways, pollute the rivers and can constitute a threat to man and his environment**.**

Garbage is the commonest type of waste generated in FCT. The composition of solid waste demands that emphasis be placed on composting and recycling as the most viable options for waste management in Nigeria. Compost replaces synthetic fertilizers and soil improver and reduces the need for pesticides, tillage and irrigation. Also, the benefit of recycling includes resource conservation, decrease land contamination by pollutant, energy savings and job creation, reducing the need for landfills and incinerations. Energy demand most especially in the developing countries can be augmented by the use of domestic solid wastes, a renewable energy source which is available in abundance. And ineffective utilization of solid wastes constitutes environmental pollution. This call for quantification, characterization and effective conversion of these readily available by-products for energy production.

Based on the findings of this study, there is strong need for the researchers to really carry out vigorous works on domestic waste with the aim of suggesting more alternative uses of wastes. This will educate and open up more opportunities for the stakeholders to improve on solid waste management in line with international best practices in the whole of FCT.

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